



Nachhaltige Inselstromversorgung mit erneuerbaren Energien



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GTZ, DED, InWEnt Fachtagung – Im Abseits der Netze -
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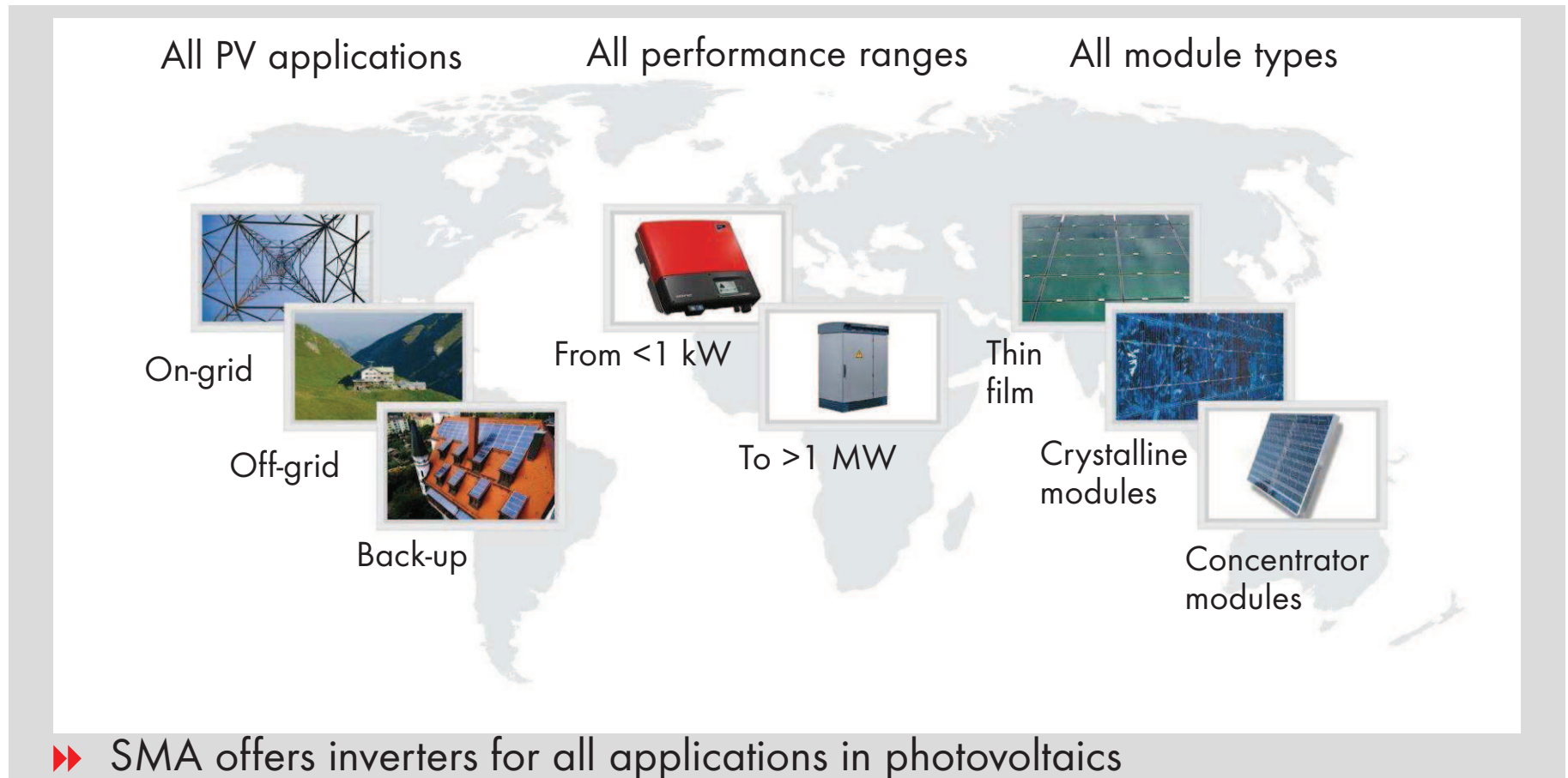
Outline

- » SMA Solar Technology, Short company introduction
- » Suitable technological solutions
- » Economical aspects
- » Best practices





SMA is market and technology leader for PV inverters





Continuous internationalization in order to take over key positions in all future solar markets



▶▶ More than 900 sales and service personnel all over the globe



Suitable technological solutions for rural electrification

1. Grid extension for urban areas
2. Genset dominated supply (Petrol, Gasoline, Liquefied Petroleum Gas)
3. Hybrid or Mini Grid power supply systems based on renewables

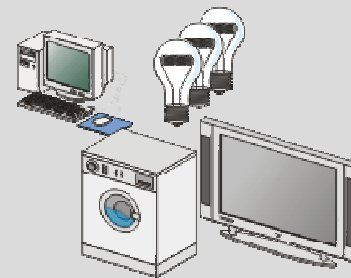




Grid extension



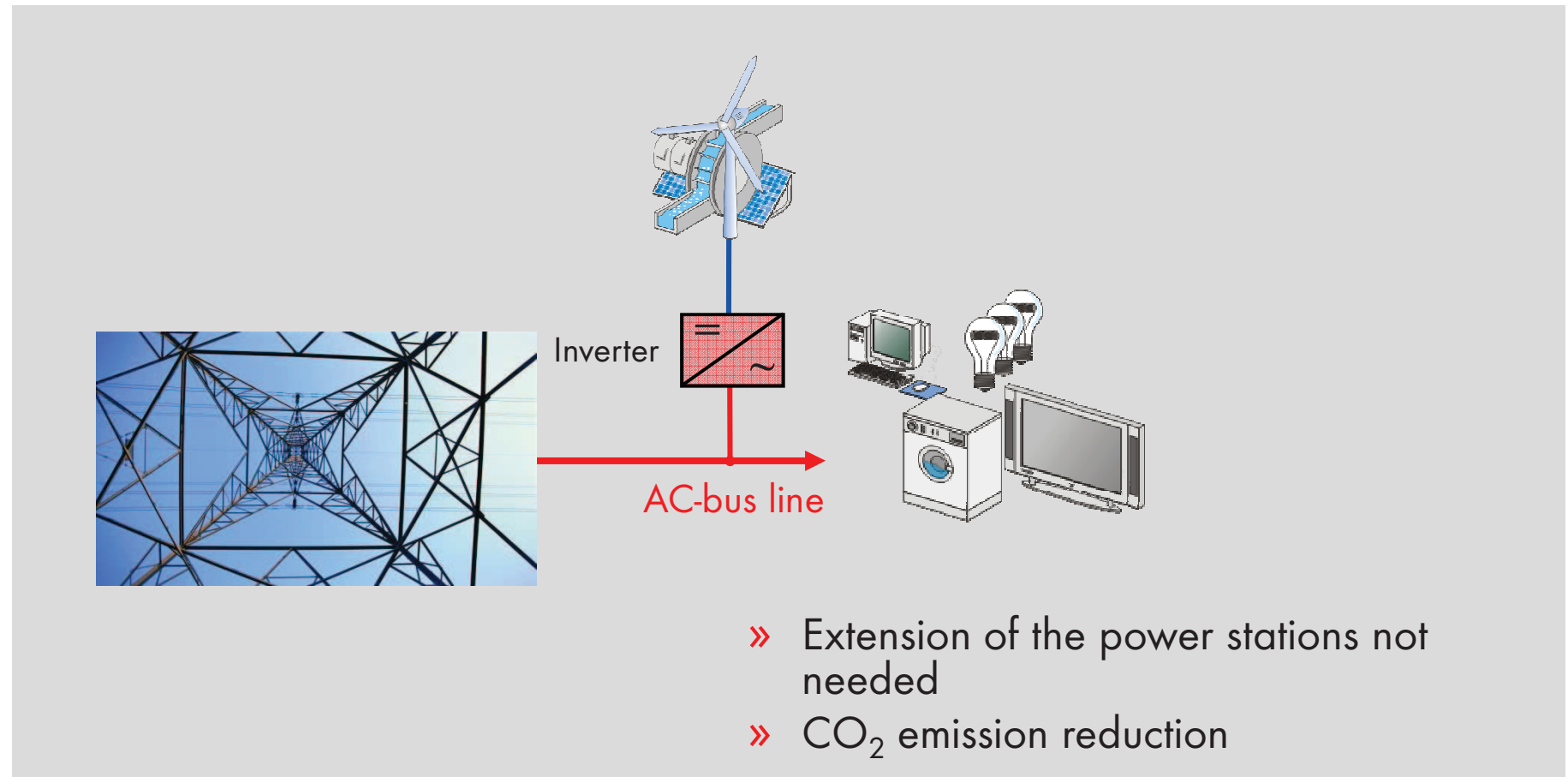
AC bus line



- » High cost
- » Low consumption rate



Grid extension for urban areas





Genset dominated power supply

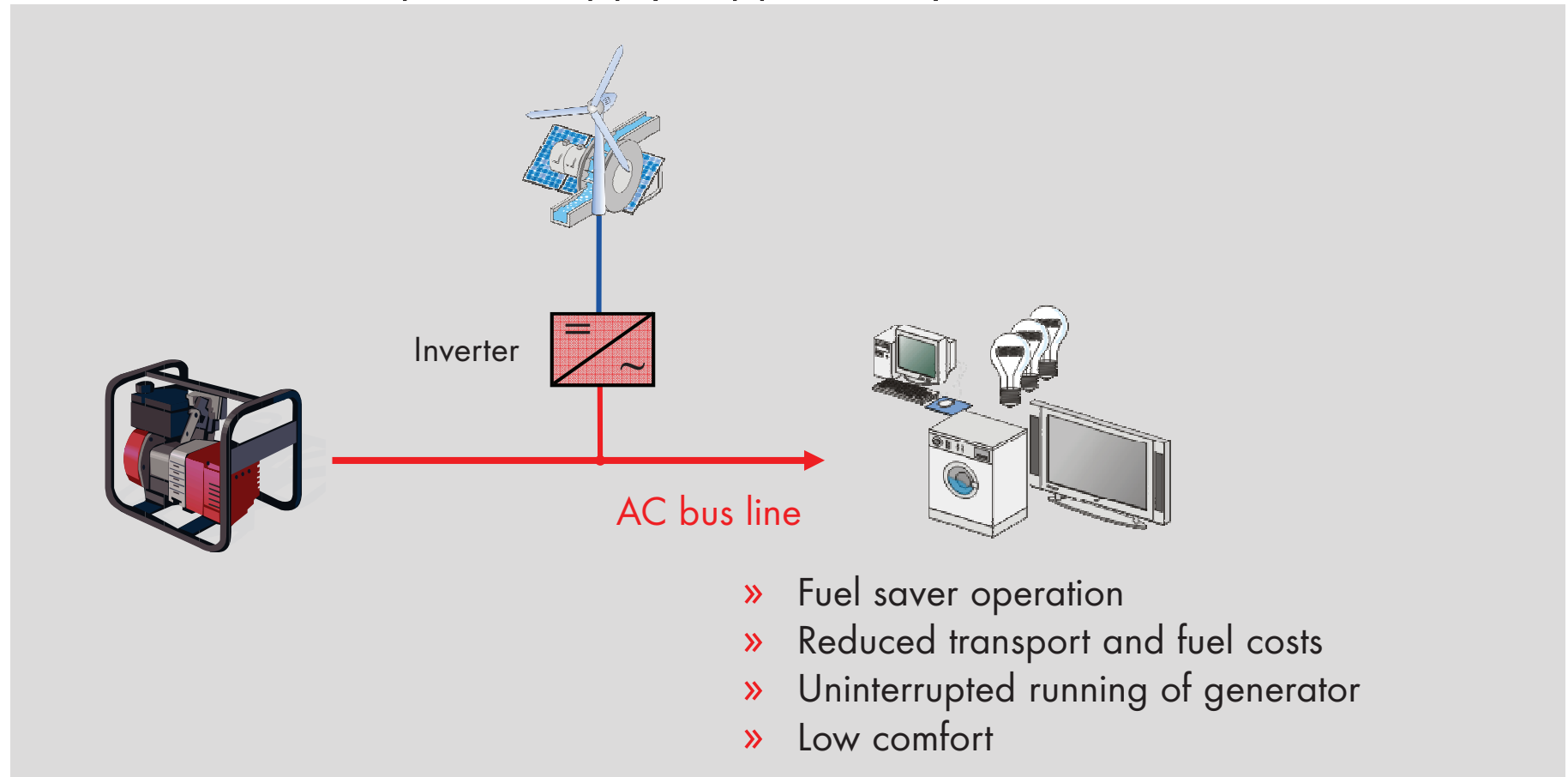
(powered by gasoline, natural gas or LPG)



- » Availability of productive power
- » High maintenance effort
- » High transport and fuel costs
- » Unacceptable environmental impact

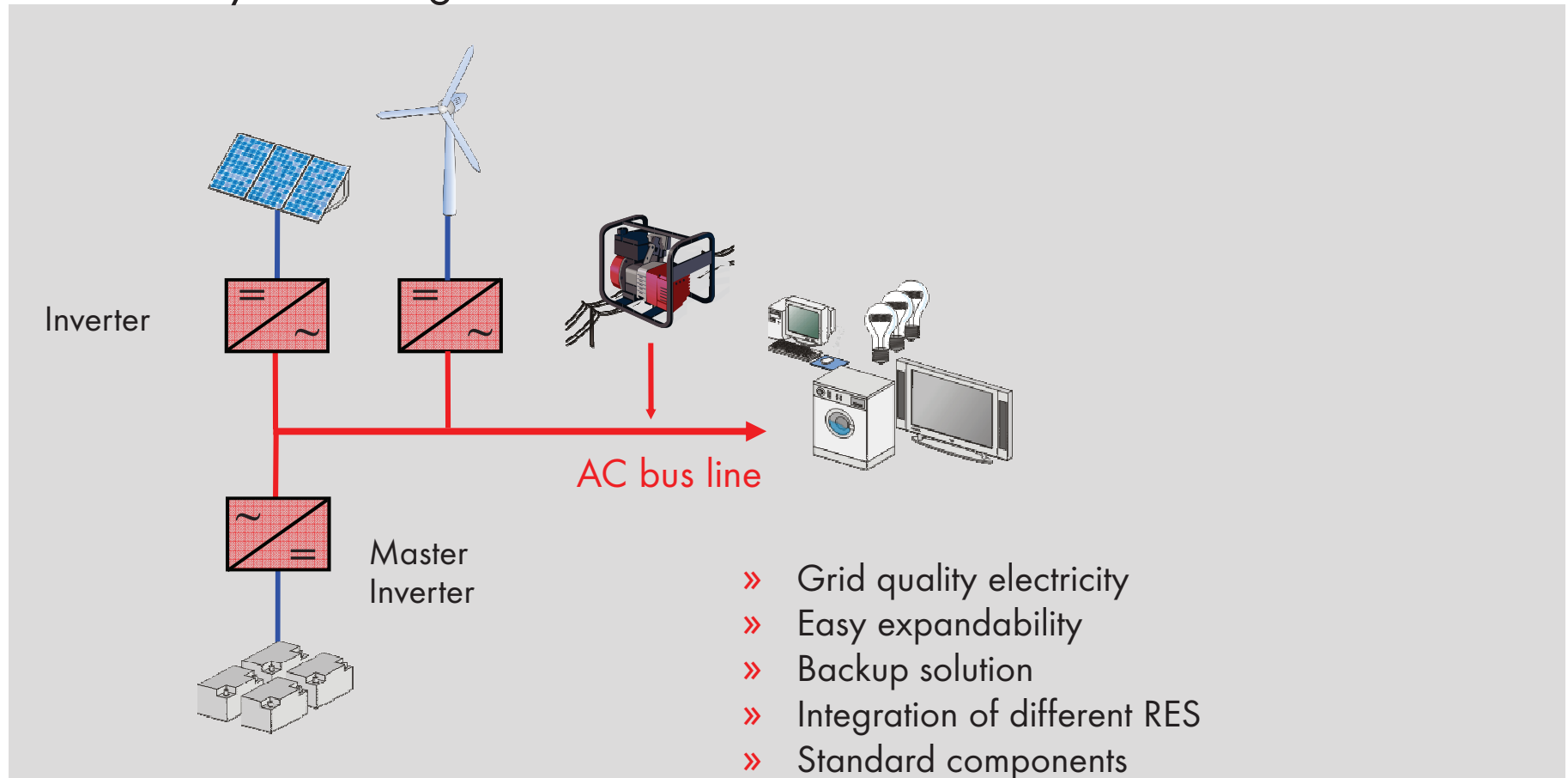


Genset dominated power supply supported by RES



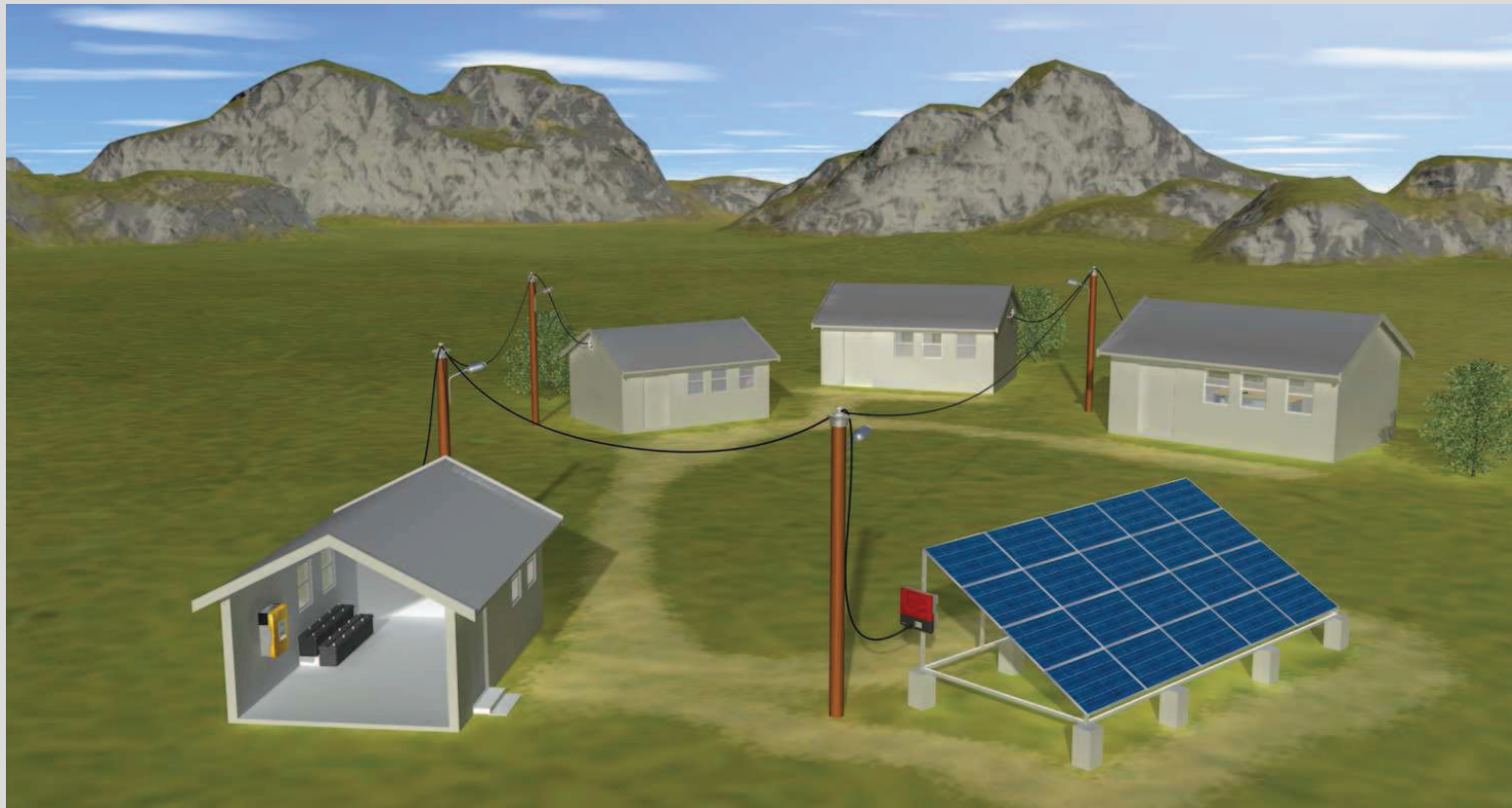


Modular hybrid design



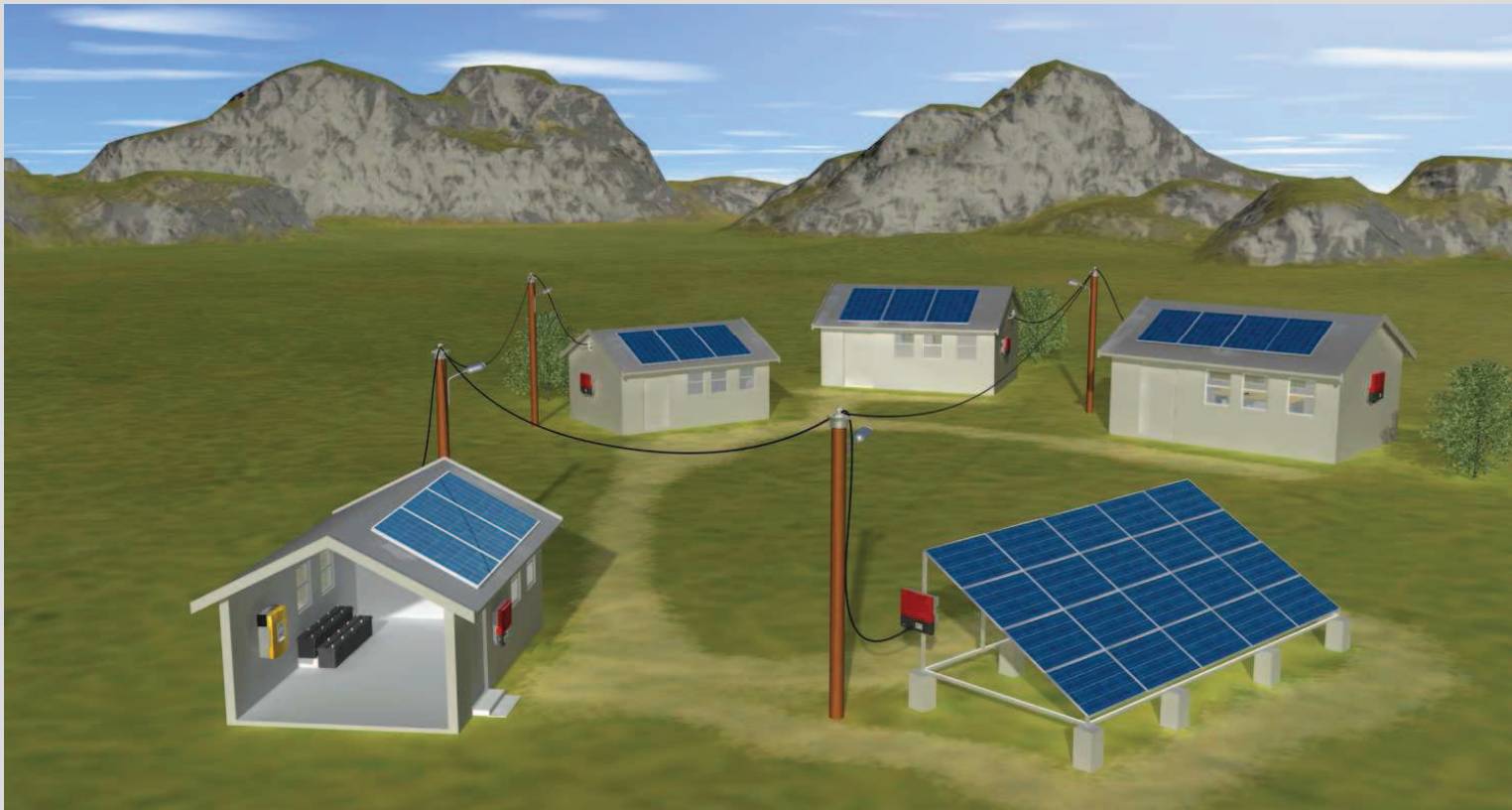


Modular energy supply



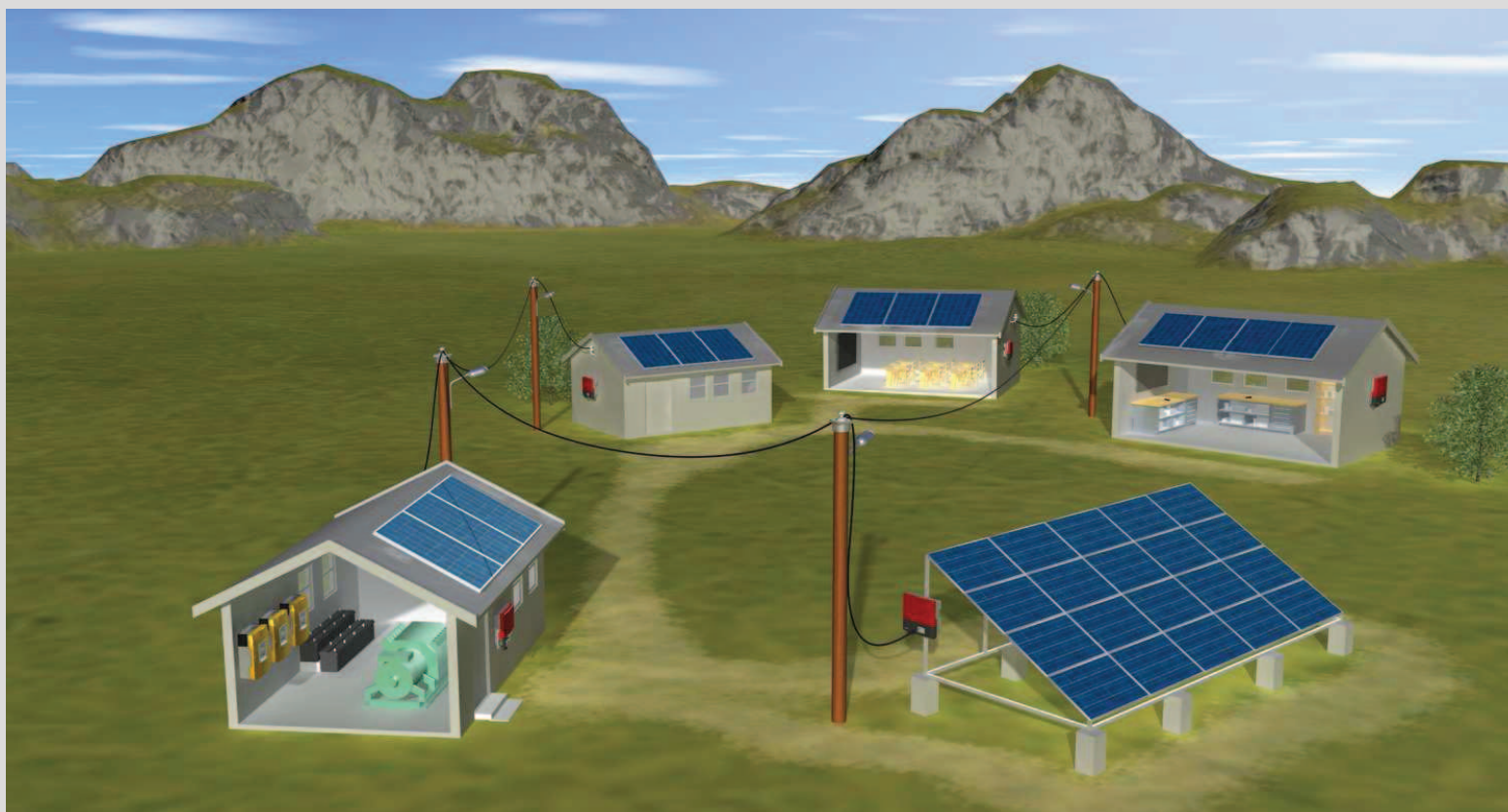


Simple enlargement



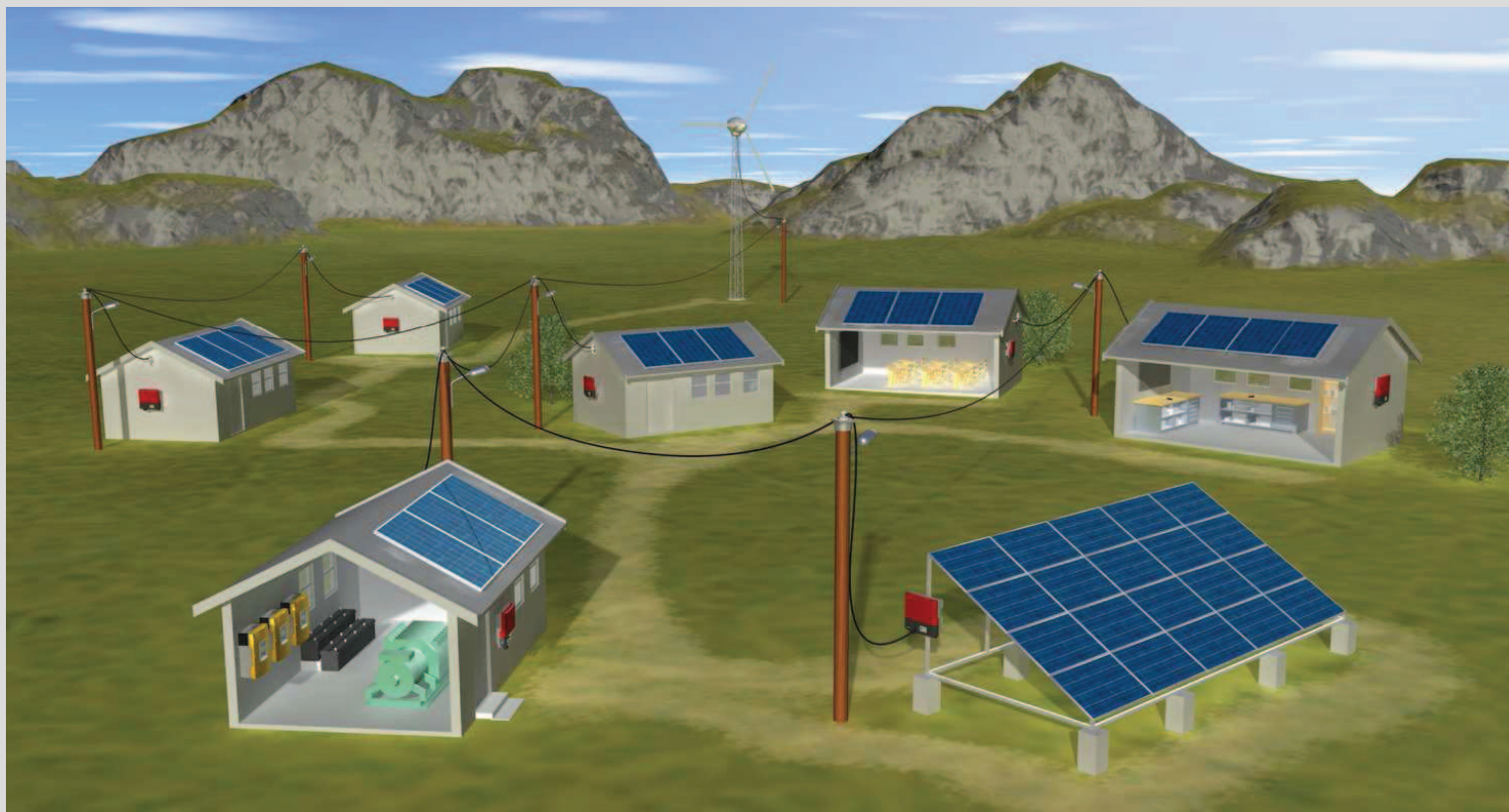


Higher flexibility by coupling all consumers and generators on AC bus line





Different local renewable energy sources are suitable to form a hybrid grid





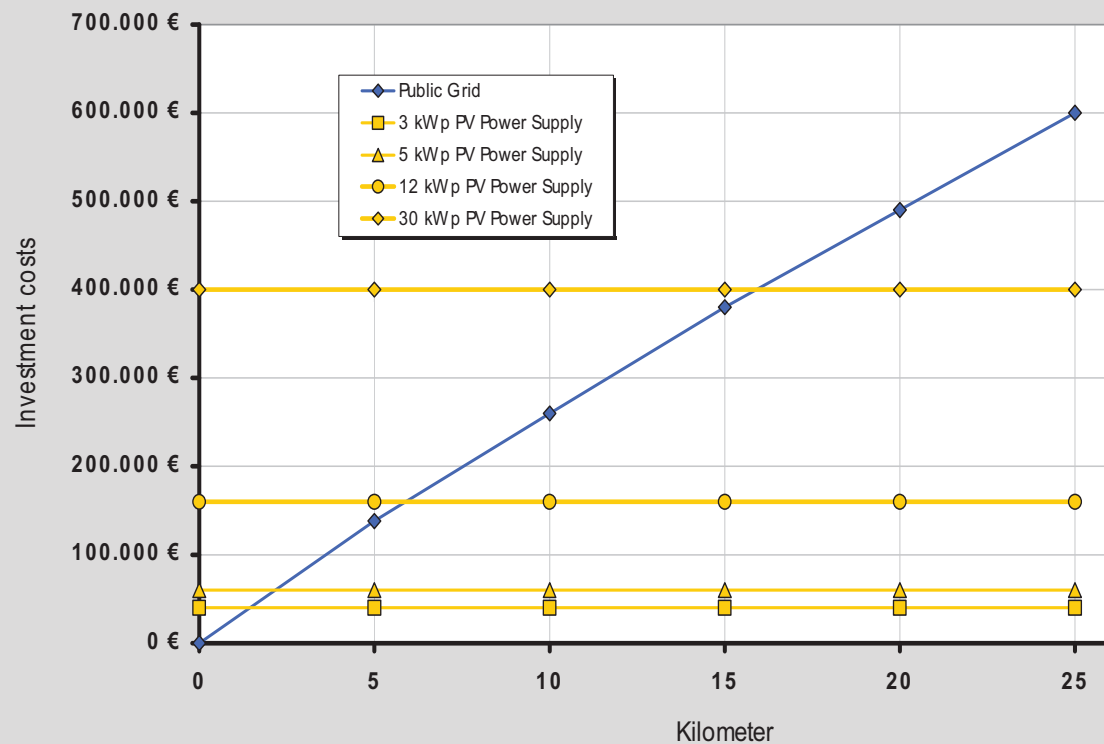
Electricity in network quality





Economical comparison: Grid extension vs. hybrid systems

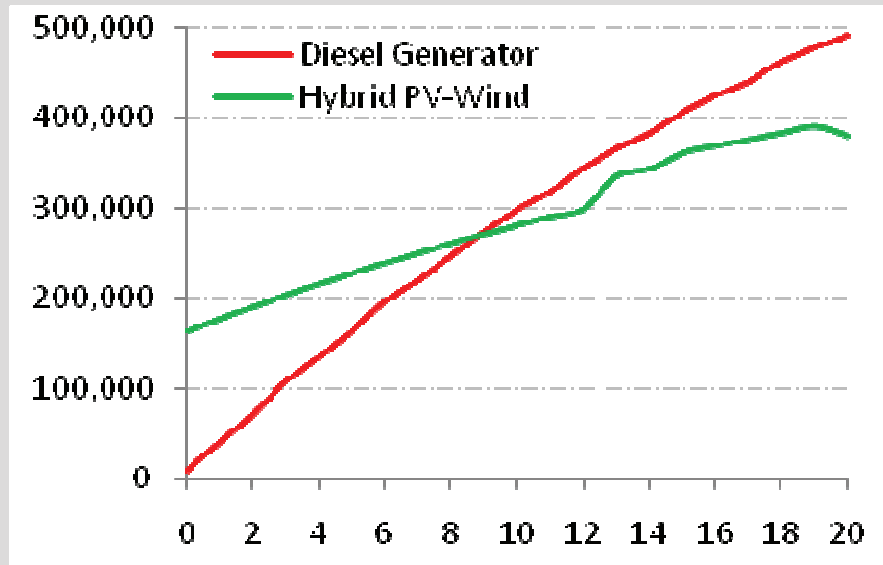
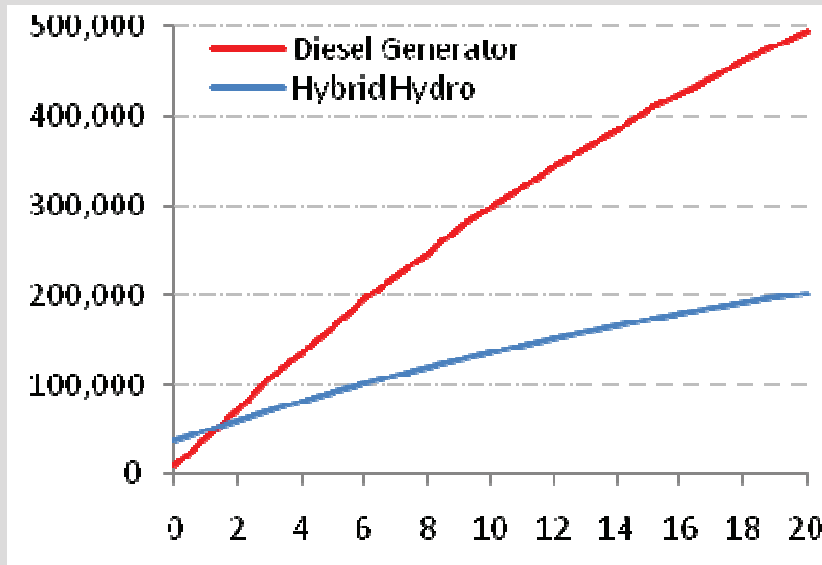
- » The extension costs are primarily distance dependent
- » The break even "distance" is therefore related to the demand



Source: Alliance of rural electrification



Economical comparison: diesel vs hybrid systems (life cycle costs)



	Genset Capacity	RET Capacity	RE Share	LCOE (\$/kWh)	Break-even
Diesel System	30 KVA	-	0%	0.538	-
Hybrid PV-Small Wind	10 KVA	PV - 35 KW Wind - 20 KW	91%	0.420	8.7 years
Hybrid Small Hydro	10 KVA	26.8 KW	97%	0.219	1.5 years

» Location: Ecuador

Source: Alliance of rural electrification

» PV-hybrid diesel-Grids is a cost competitive solution for rural communities



Analysis of Sensitivity: Benefits of PV Hybrid Systems



- » With state-of-the-art PV-system costs as well as Diesel fuel prices, a 30 kW PV hybrid system is approx. 20 % cheaper (regarding TCO)
- » Above Diesel fuel costs of approx. 0,8 €/l, the PV hybrid system will stay more cost effective
- » With another decrease of PV system costs to half of today's price level, the costs of a PV hybrid system will only be 50 % of the costs for a full diesel power supply.
- » **PV hybrid systems** are the **only sensible way** for remote habitations to guarantee a **24/7 power supply!**



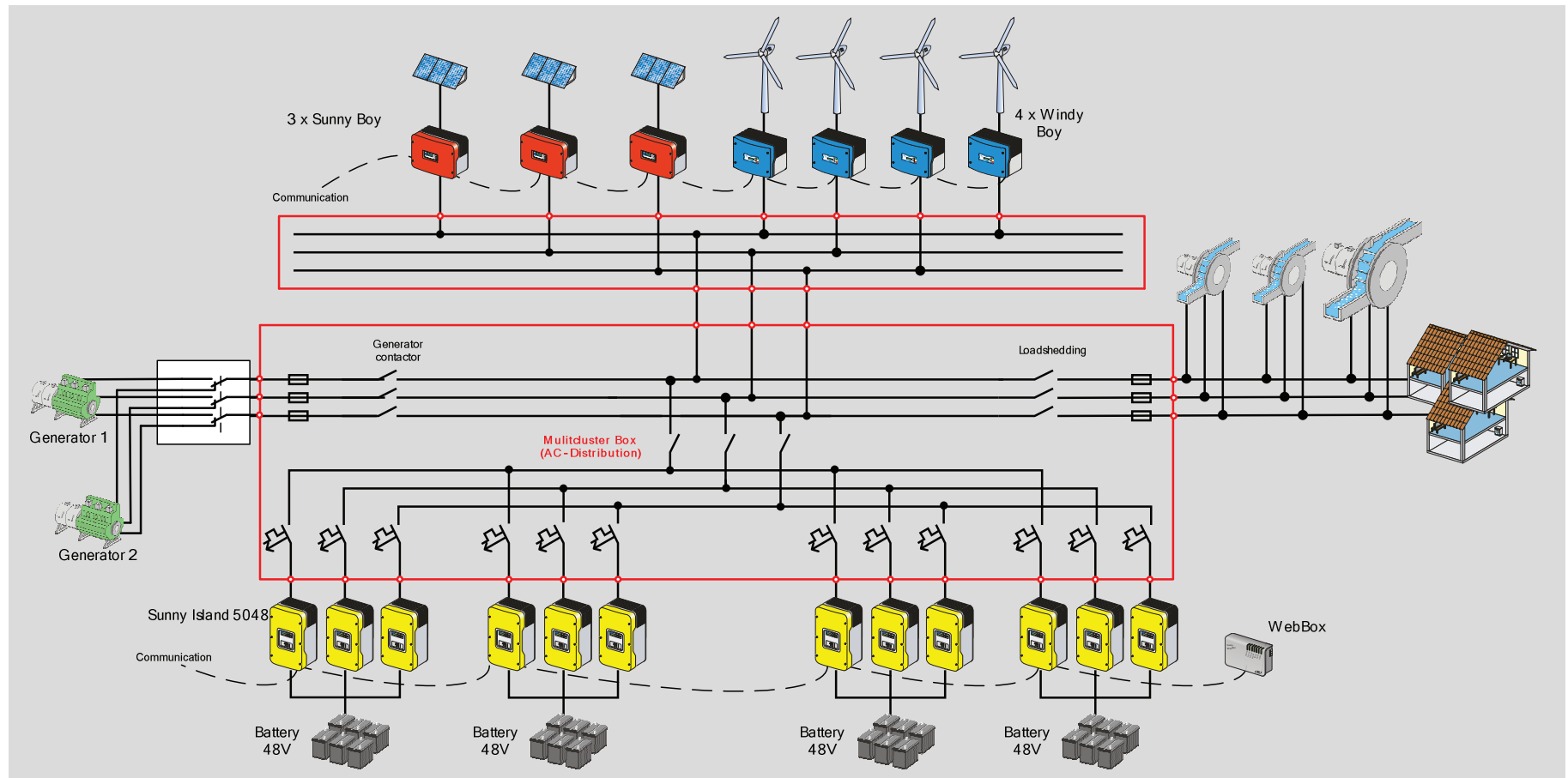
Off-Grid Power Supply Isle of Eigg, Scotland



- Scottish Inner Hebrides
- 16 km distance to the coast
- North to south extension of 9 km and a 5 km east to west extension
- Harboring around 100 residents
- The community consists of 45 households, 26 business and 6 community buildings



Off-Grid Power Supply Isle of Eigg, Scotland





The System Control Unit



- Battery inverter power: 60 kW
 - Battery bank: 212 kWh
 - Generator is only needed as reserve power
- ▶▶ 24 h power from batteries



Frequency Shift Power Control



- Frequency is shifted if battery bank is full and more renewable power is produced than being used – Control steps:
 1. Connect space heaters via frequency controlled switches
 2. Connect dump loads via frequency controlled switches
 3. Output power of Hydro, Wind, Solar will be limited



Sayed Karam - Paktia Province power supply for 600 houses and small businesses



PV plant: 390 x 205 watt Kyocera PV panels,



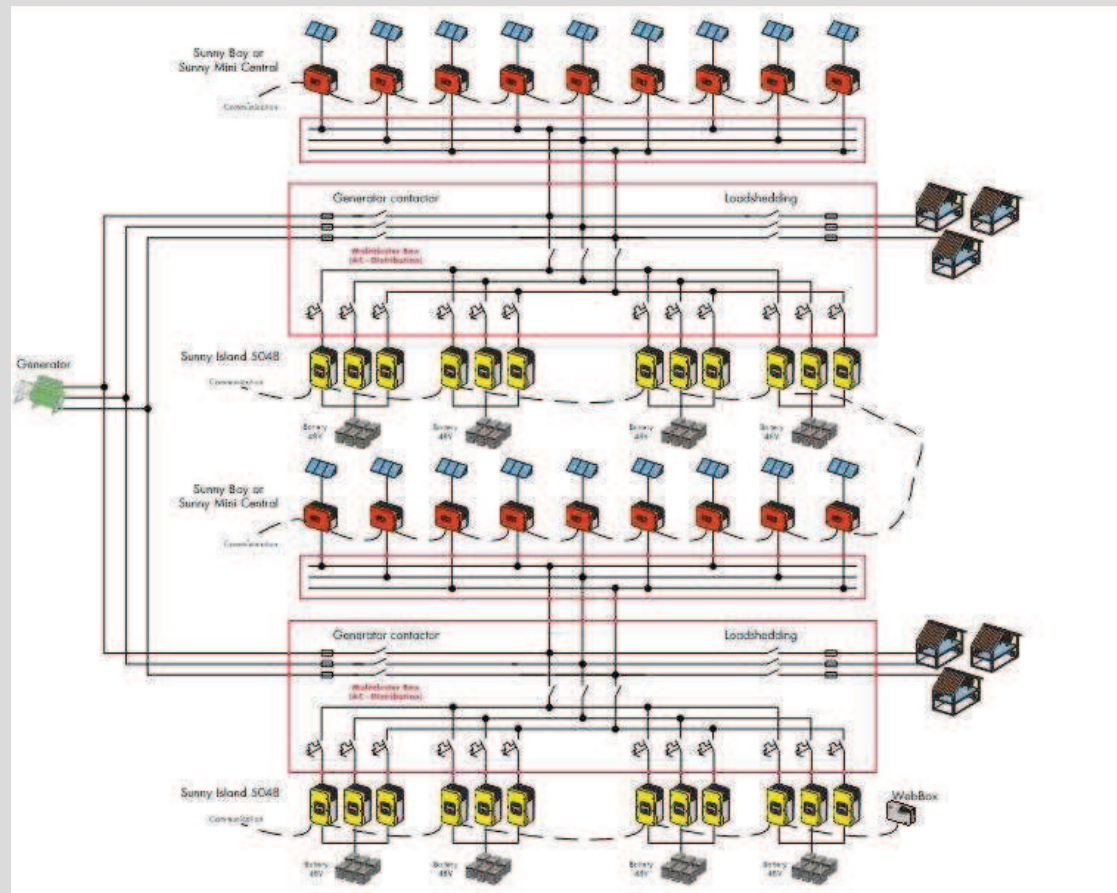
Multicenter with 21 x Battery Inverter



Sayed Karam - 14 km distribution lines with 20 KV transmission line

100 kW
Solar PV
system

Diesel:
Generator:
250 kW
diesel back
up



Every
connection has
a pre pay
meter

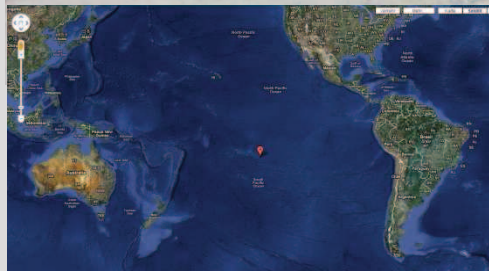


Sayed Karam – Installation by local technicians





South Pacific (Tahiti) Reao



Power supply for 40 houses and small business

- 18 x Sunny Island 5048 battery inverters: 90 kW
- Battery bank: 1842 kWh
- Photovoltaic: 140 kWp
- Dieselgenerator: 120 kVA
- 1 x Multicluster Box 36.3

▶▶ 24 h power from batteries



South Pacific (Tahiti) Reao





System Characteristics

Large-scale modular hybrid system

- with **standard components**
- loads & generation coupled by a **medium or low voltage grid**
- Controlled by **grid frequency and SOC**
- **high reliability** achieved by using a modular concept
- **easy service** performed by local electricians





Customer Assistant

System pre-sales support

System advice and design assistant

Off-Grid seminars

Commissioning

Practical training

Maintenance training

Sunny Island Service line
++49 - 561 - 9522 - **399**

Standard product warranty 5 years





Thank you very much for your attention !

Be realistic,
let's try the impossible!

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